month resulted in floods in many parts of Italy. The Tiber is reported to have risen to 50 feet, making it the worst flood experienced in Rome since February, 1915. Other large towns to be severely affected were Pisa, Florence, and Naples. Cold weather with heavy falls of snow occurred generally over the whole of Europe even as far south as the Riviera during the first half of the month. At Majorca the temperature was almost down to freezing point but the weather was sunny. In Central Europe the snowfalls were so heavy that railway and telegraph communications were broken in several places. The ice on the Elbe above Hamburg was so thick that the river could be crossed on foot; navigation on the tributaries of the Rhine also came to a standstill about the 16th. For the first time since 1917 skating was permitted on the lakes in the Bois de Boulogne (Paris) on the 17th and 18th. After a milder spell lasting about three days heavy snow fell generally on the 25th, and as far south as the Riviera on the 25th, 27th, 28th. Severe cold was experienced during this time with violent storms in Yugoslavia.

On the 23d and 24th after a week of severe weather there was a heavy fall of snow in Jerusalem. Gales and snowstorms accompanied by high tides caused much damage along the northeastern coasts of Japan during the first week of the month.

In the same issue of The Meteorological Magazine, under the caption "The winter of December, 1928, and January and February, 1929" the following explanation of the severe cold in Europe during February, 1929, is given:

> At the beginning of February a large area of low pressure developed over the North Atlantic, and pressure over Iceland fell rapidly, but in the meanwhile an extraordinarily intense anticyclone had developed over northern Russia, pressure reaching nearly 1,060 mb. [31.30 inches] over the Urals on January 29. The anticyclone continued to advance westward, and has occupied northern Russia and the Baltic region during the first half of February. It is an offshoot of the great winter anticyclone of Siberia, with which it is connected by a ridge of high pressure in about 60° N. latitude, and on its southern side a great current of intensely cold air from Siberia drifted across Europe.
>
> The second week of February was accordingly intensely cold over central Europe, and at this writing [probably about February 15] the cold shows no sign of abating. * * *

ATMOSPHERICS AND TROPICAL CYCLONES

551.515(213)

By FATHER E. GHERZI, S. J., *in charge weather and seismic services*

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In a research published in 1923 concerning the radio reception in Zi-ka-wei of the Bordeaux press and time signals, during the typhoon season, we had the occasion of advancing that the tropical cyclone, contrary to the extratropical cyclone, is composed only of equatorial air.

Further data obtained from ships, which had passed through the center of these powerful and destructive centers, confirmed our first idea and recently also the Japanese meteorologists have agreed that in a typhoon there is no temperature discontinuity. (Compare, for instance, The Memoirs of the Imperial Marine Observatory Kobe, on the Typhoon of the Far East, by Yosiki Horiguti. 1926 to 1928.)

We had advanced our theory on the ground that in the radio reception, those disturbances so well known to all the radio operators, which have been called "statics" or "strays" or "atmospherics," had really decreased with the approach and especially in the central area of these tropical cyclones.

In an article published by the Air Ministry of London, in the Marine Observer through the kindness of the marine superintendent, Commander L. A. Brooke-Smith, in August, 1925, we asked that similar researches might be made elsewhere in order to compare the results.

Later on the U. S. S. cutter *Kittery*, in a campaign around the Antilles had the occasion of making some observations, with a recording loop receiver, not far from the central zone of the so-called "Miami cyclone" (namely a typhoon or tropical cyclone).

The conclusions given in a "Notice" published in the Pilot Charts issued by the United States Hydrographic Office, showed that in that cyclone the "atmospherics" had been very strong all over the typhoon area.

The ship herself had not been in the center and even not in the real stormy region as her barometer's lowest reading had only fallen to 29.56 inches. This barometric pressure (every sailor will admit) is quite near the normal value for the tropical regions during these months of cyclones.

So much that we declined to admit that the experiences of the U. S. S. *Kittery* did really consider the problem long the line which we think is the right one, and which we have been able to follow, owing to the kindness of the captains of the ships which had really gone through the centers of the typhoons quoted by us. (Compare The Marine Observer, August, 1925, and August, 1928.)

Since Sir Napier Shaw in his Manual of Meteorology, Volume II page 371, edited in Cambridge in 1928 [1] seems to admit that the U. S. S. *Kittery* reports would contradict, in some ways, our own experiences for the far eastern seas, we think convenient to state again how the research should be conducted for making a comparison with our own possible.

In the typhoon region (taking this in a general sense) three concentric zones should be admitted.

1. The zone where the circulation of the wind begins to be cyclonic. There we have found "atmospherics" and local thunder storms, which are, we think, by and by dissolved by the approach of the real typhoon zone.

2. The zone where the cyclonic circulation is real and fresh but the barometer has not yet begun the V characteristic of the typhoon barometric curve and the value of the pressure is yet relatively normal, just as in the case of the U. S. S. *Kittery*, concerning the Miami cyclone.

There "atmospherics" are also present but they have been reported as relatively decreasing.

3. The central zone (not only the central part with its characteristic "calm"), with its steep barometric gradient showing a V on the barographic record.

There, according to the examples we have been able to quote in our articles, the "atmospherics" had almost disappeared and in some cases have been completely absent, although there had been heavy and blinding rain squalls and hurricane winds during the time of the observation.

These are the facts already quoted. We would like to know how things happened on ships having gone through the center of the cyclone, in low latitudes,[2] over

[1] "* * * Gherzi has cited instances of steamers passing through centers of typhoons and experiencing no atmospherics * * *. On the other hand reception of Arlington was impossible (owing to static) when the Nassau and Miami hurricanes were between Arlington and U. S. S. *Kittery* in the West Indies seas."

[2] Once a tropical cyclone is on the northeasterly course, some envelopment by polar cold air should be admitted, with corresponding "atmospherics" in the radio reception,

the Antilles region. We are afraid some ships had this trying experience and their reports should be compared with those of our far eastern seas.

Coming now to the way of finding the "atmospherics" region by means of a revolving loop, either close to the center, but not in the center, or some distance away, as in the case of the U. S. S. *Kittery*, everyone who has been practicing with this kind of instrument will agree that it shows only a direction, but not a fixed and special place along that direction. In the case of the U. S. S. *Kittery* reports as the ship was outside of the real typhoon zone the registration showed only that there was a region with "atmospherics" around the center, or, may be, beyond the center, even very far, but not in the center.

Even using two loops, these would point to a possible ring of atmospherics around the center just as we agree it can exist in zones 1 or 2.

Only by passing through the center, a very disagreeable experience (we quite admit it), can the phenomenon we have quoted, be controlled and checked elsewhere?

I will add a few words concerning the meteorological aspect of the typhoon central area (not the center itself) which may help to explain this absence or decrease of the "atmospherics."

First of all the rainfall distribution, at least at sea, seems to be practically homogeneous all round the center. In the center itself it ceases, as a rule. That shows that in a tropical storm there is no squall line. This peculiarity, we think, is of great importance.

In the second place, the intensity of the wind, at sea, is also practically equally great all round the center. There is not the sharp distinction which is found for the extratropical cyclones, where in the southeastern and southern sectors the wind is rather light, with warmer temperature and prevailing fog. There is no real fog in a typhoon region. The rain is blinding and thick, but that is not what the meteorologists call mist or fog.

These two points converge in showing that the typhoon core is rather homogeneous and this homogeneity seems to us to explain the absence of atmospherics in the center itself, once more according to ships that passed through it and kindly reported to us their radio experiences.

New edition of Physics of the Air.—Our readers will be interested in knowing that a new edition of this standard work by Dr. W. J. Humphreys has been published by the McGraw-Hill Book Co. of New York. This is not a mere reprint of the old edition. A new section on meteorological acoustics has been included. A discussion of atmospheric turbulence and a much fuller account of the relation of wind velocity to height have been given, and numerous other topics either enlarged or newly added, thus bringing the book down to date.—*A. J. H.*

The Norwegian Weather Service.—The 1927 yearbook of the Norwegian Meteorological Institute, just received, tells of the 122 stations of the Norwegian weather network, and gives hourly values of pressure, temperature, precipitation, and atmosphere electric potential gradient for Oslow or Aas, the term observations for 10 stations and the monthly and annual résumé for all stations. Departures from the normal sea temperatures along the coast and observations at Green Harbour, Spitzbergen, and on Jan Mayen, are included in appendixes. Of the 122 stations, 57 have mercurial barometers, three-fourths of these with millibar scales, 71 have psychrometers or hair hygrometers, about 50 operate barographs, 20 have thermographs, and 6 have hygrographs. The equipment of 51 of the stations is simply a dry thermometer. The instruments are exposed in window shelters except for the stations with thermographs.

The daily precipitation at 186 rainfall stations is published in Nedbøriakttagelser i Norge for 1927, as is also the daily snowfall for 48 stations. A map (1:1,300,000) shows in detail the distribution of rainfall for the year, from maxima of 2,400 to 2,600 mm. at 5 points near the southwest coast and 1 farther north, to minima of under 800, 600, or 400 in the southern and central interior, and under 300 in the northern interior. The maximum rainfall for the year was at Vassbo, in the extreme southwest, latitude 58° 41′, longitude 6° 21′ E., altitude 78 m., and 35 km. from the coast. In the 11 months, January to November, the precipitation was 2,599 mm. (102 inches) on 244 days (with 0.1 mm. or more). The December record was zero, and at Hogstad, near by, only 1 mm. (normal 229). Nineteen hundred and twenty-seven was a relatively dry year, with little or no precipitation in the cold December, even on the rainy coast. At Bergen there was but 4 mm., compared with a normal of about 200.

The normals of rainfall for Norway have been brought down to date and published by the Meteorological Institute in 1928. Three stations have over 3,100 mm. on the average: Kvitingen, 3,120 (latitude 60° 28′, longitude 5° 24′ E., altitude 315 m.); Haukeland, 3,147 (124 inches) (latitude 60° 50′, longitude 5° 34′ E., 240 m.); and Hovlandsdal, 3,135 mm. (latitude 61° 14′, longitude 5° 26′ E., altitude 122 m.). These are all near Bergen, and 30 to 40 km. from the open sea. Vassbo has too short a record for a normal yet.—*C. F. B.*

The typhoons of 1927.—In the Far East tropical cyclones are known as "typhoons." Father E. Gherzi, S. J., has presented to the general chamber of commerce of Shanghai, China, a report upon the typhoons of 1927 for which warnings were issued by the Zi-Ka-Wei Observatory near Shanghai. Thirty-three typhoons of all classes were located on the synoptic charts of the observatory but only 23 of them have been definitely tracked. The distribution by months is as follows: February, 1; March, 2; April, 0; May, 2; June, 1; July, 2; August, 4; September, 5; October, 4; November, 1; and December, 1.

The inference is that the remaining 10 storms were not so clearly in evidence as to warrant an attempt to plot them.

It is interesting to note that the observatory classes as a typhoon all tropical cyclones that have their origin south of the Tropic of Cancer. In a recent compilation made by forecaster Charles L. Mitchell of the United States Weather Bureau it was shown that only 72 per cent of all of the tropical cyclones that were located on the weather charts for North America of the last 50 years reached full hurricane intensity. Hurricane intensity is defined as a central, or near central, pressure of 29 inches and a wind velocity near the center of at least 60 miles per hour. It would seem that in the Orient about the same proportion holds good.—*A. J. H.*

Tornadoes and line squalls on January 18, 1929.—On this date a small tornado occurred in Scott County, Mo., in which three persons lost their lives and the property damage was about $15,000. On the same date a line squall swept over Kentucky in which four persons were killed and five injured and the total property loss was estimated at $1,250,000. The details appear in the table of severe wind storms on another page.

Wettest November in Southern Panama.—The Pacific slope of Panama in the cool months of the Northern Hemisphere is usually the lee slope, under the general westerly or northerly winds of this month, and is therefore much less wet on the average than is the northern, windward half of the Isthmus. (See L. T. Chapel, Winds and Storms on the Isthmus of Panama, Monthly

Weather Review, December, 1927, pp. 519–530). The Monthly Meterological Report for November, 1928, of the Department of Operation and Maintenance of the Panama Canal, shows for this month a reversal of the usual pressure gradient, and with it the wettest month on record for the Pacific slope of Panama. The monthly mean bihourly pressure was 29.835 inches at Balboa Heights and 29.831 at Cristobal. The small excess of pressure at the Pacific coast over that at the Atlantic and the consequent light winds permitted probably greater raininess on the Pacific slope than if the winds had been stronger, for the rains of Panama are typically of the local shower type. The rainfall of the Pacific section was generally twice the average, and ranged from 9.91 at Taboga, which is normally the driest place in Panama, to 44.29 inches at Mariato. Balboa Heights had 20.51 inches of rainfall, more even than Gatun, that normally has twice the rainfall of Balboa. Rain fell on 23 days at Balboa and on 30 days at Cristobal.

The failure of the norther of November 23 to reach Panama after coming as far as Costa Rica, where it was apparently responsible for the devastating floods at this time, may have been due to the reversed pressure gradient over Panama this month. However, it is worthy of note that the heaviest rain of the month at San Blas Farm, in northern Panama, 7.20 inches, fell on November 23. [This was a quarter of the entire rainfall at that place for November.]—*C. F. B.*

Meteorological summary for Chile for December and also the year 1928 (by J. Bustos Navarrete, Observatorio del Salto, Santiago, Chile).—December.—Atmospheric circulation over the South Pacific Ocean was a little more active in the first and last decades of the month. The depressions most important in producing unsettled weather and rains in the south were those charted during the following periods: 1st to 3d, 4th to 5th, 6th to 7th, 18th to 19th(?), and 28th to 30th. The condition of foul weather and rain between Chiloe and Talca during the first days of the month was a feature well worth mention.

The most important anticyclonic centers, accompanied by fine weather, showed the following positions and movements: 1st to 14th, from Coquimbo to Juan Fernandez, Chiloe, and Argentina; 17th to 18th, over Chiloe; 19th to 20th, from Juan Fernandez to Chiloe; and 24th to 27th, from Chiloe toward Argentina.

In the central zone the weather was variable in the first decade, but uniform in the second and third decades. In the southern zone there was an increase in precipitation; at Valdivia the total for the month was 9.17 inches.

Year 1928.—The slight anomalies presented were unequal distribution of rainfall which occurred mainly in the central zone between April and June, and gradual increase in temperature and dryness beginning with July. On the whole this year had more precipitation and somewhat lower temperature than the year 1927.

The months of January and February had lower temperatures than the same months of the preceding year; the summer was more moderate. The winter months were cold, but not severe, with lowest mean temperature in June. Beginning with July there came an increase in temperature, a rare occurrence since normally the minimum appears in July or August.

At Santiago the highest temperature was 91° on February 22 and the lowest 28° on June 25 (lowest in Chile, 11° at Caracoles on June 24). The total annual precipitation was 13.82 inches, June being the rainiest month with 5.94 inches. In the cordilleras the average depth of snowfall was 3 meters (9.8 feet).

The most notable phenomena of the year were the torrential rains occurring at the beginning of April between Curico and Talca, 5.50 inches in 48 hours; in the mountain region snowfall was extraordinarily heavy and caused great damage. The heavy downpour at Valdivia on June 9 gave 6.97 inches in 24 hours.

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